

Influence of Glufosinate Tank-mix Combinations with PPO-inhibitors on Waterhemp Control and Soybean Development and Yield

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Cropping Systems Weed Science
UNIVERSITY OF WISCONSIN-MADISON

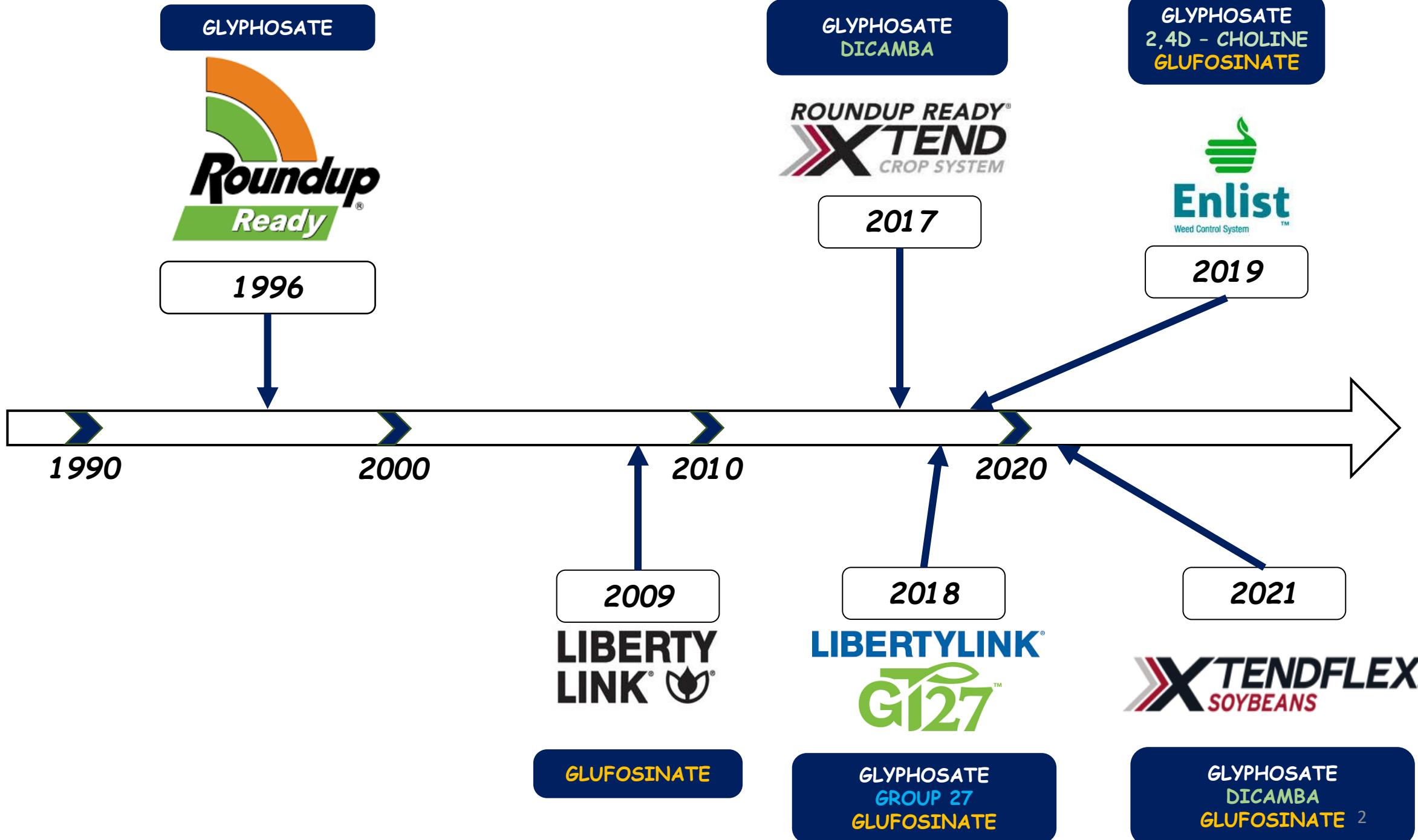


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“According to our latest study, due to COVID-19 pandemic, the global glufosinate market size is estimated to be worth \$ 422.9 million in 2021 and is forecast to a readjusted size of \$816.6 million by 2028 with a CAGR of 9.9% during review period.”

Search, locate, and access a wide range of global market report titles for a variety of industries, sectors, verticals etc.

Source: marketsandresearch.biz

January 2022

TOP INDUSTRIES

We are driven by a constant urge to scan and research market scenarios across all regions and continuously update and upgrade existing reports, and create and add new, unique, and meaningful reports to our ever-growing repository.

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- Consumer Goods
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- Equipment and Machinery
- Financial Services
- Food and Beverages
- Healthcare
- Manufacturing and Construction

- Medical Devices
- Metals and Minerals
- Packaging
- Pharmaceutical
- Semiconductor and Electronics



A common scenario in the field



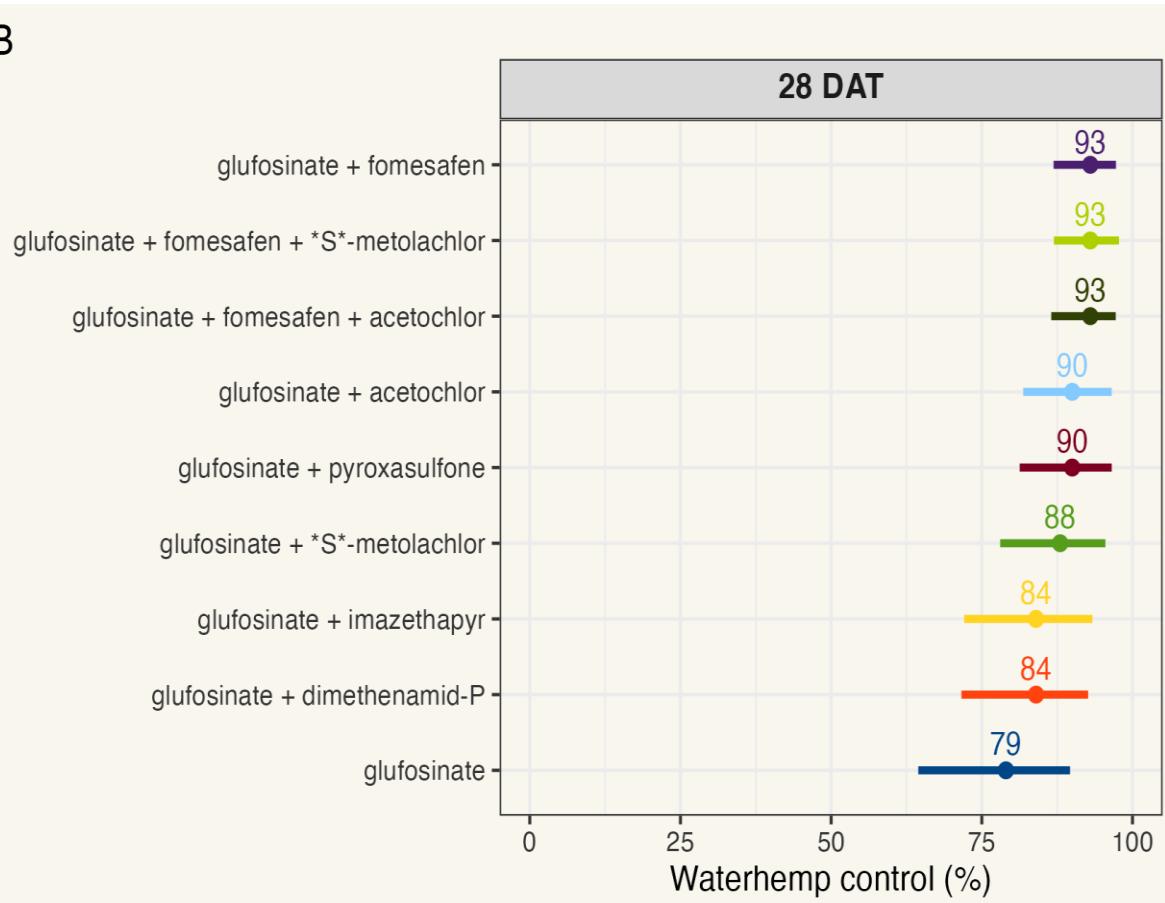
Credit: Dr. Rodrigo Werle

4 Site-Year Study

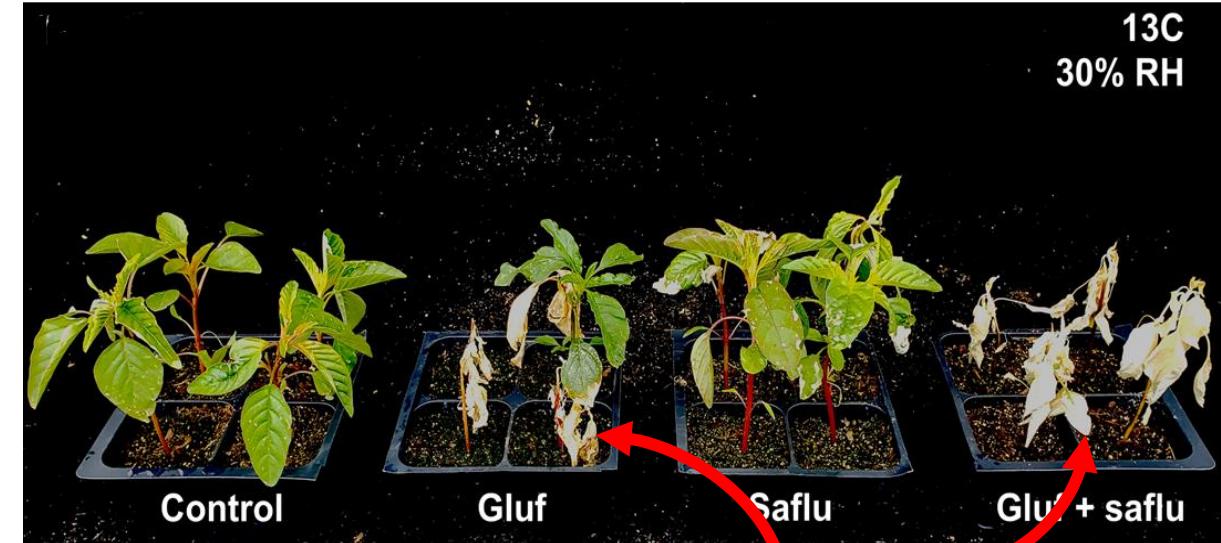
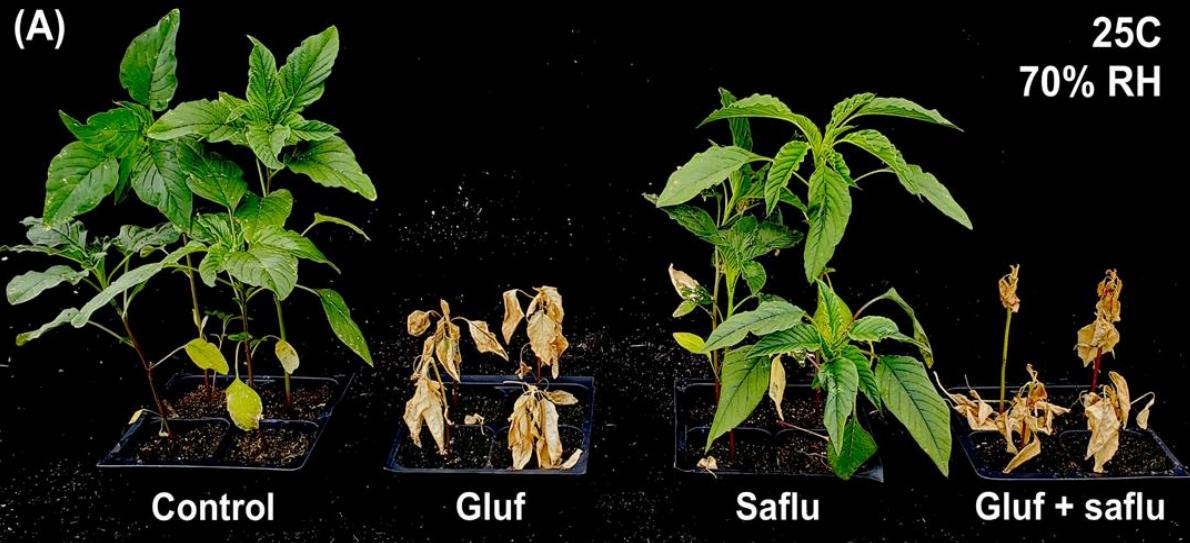
Wisconsin (2019 & 2020)

Waterhemp Management in Southern Wisconsin Using a Layered Residual Approach in Glufosinate-Resistant Soybeans

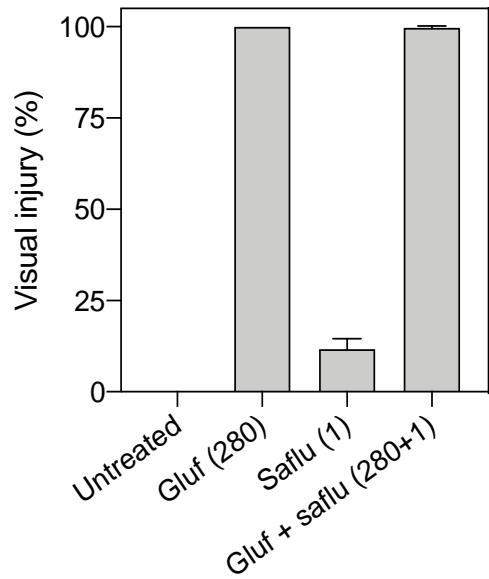
B



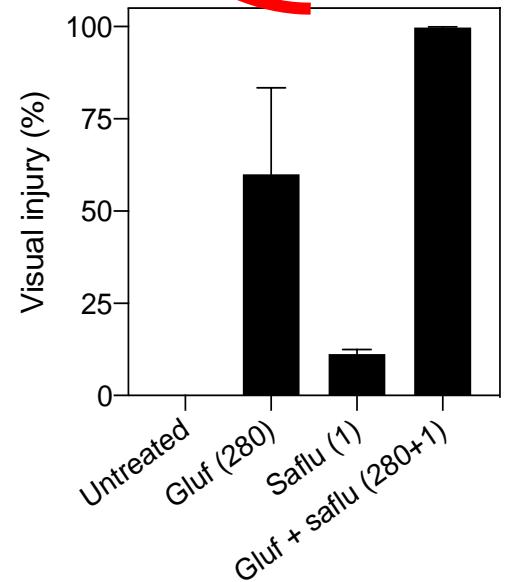
< Consistent waterhemp control over 90%



Overcoming Low Temperature/Humidity?



Slide courtesy of Dr.
Hudson Takano; see
Takano et al. (2020):
<https://doi.org/10.1017/wsc.2020.39>



Objective & Hypothesis

Objective: Evaluate the influence of *glufosinate* (Liberty 280 SL; Glutamine Synthetase Inhibitor, group 10) tank-mix combinations on waterhemp control, crop injury and yield in Enlist E3 soybeans

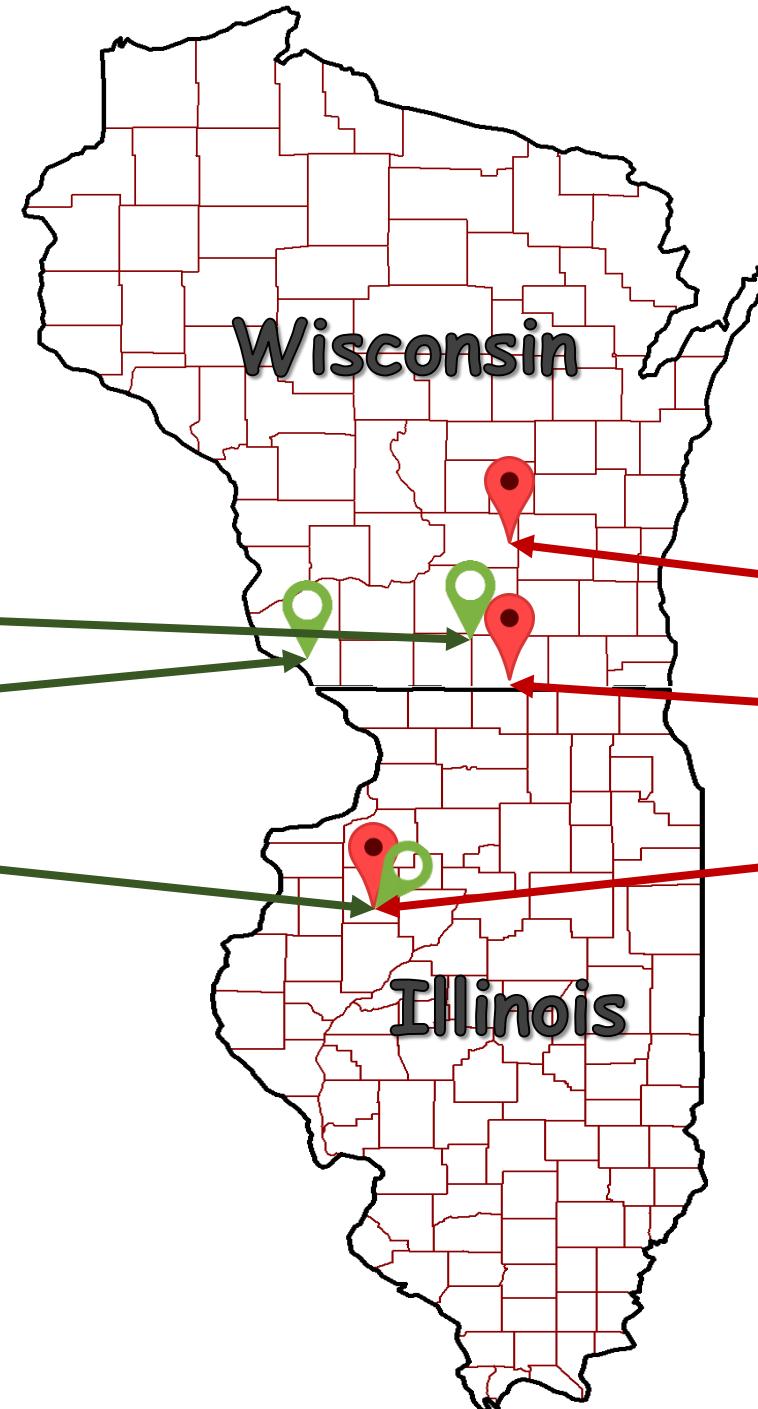
Hypothesis: Glufosinate tank-mix combinations will increase the levels of waterhemp control, with no major impact on soybean development and yield

2020 & 2021

**Waterhemp
Response
Study**

2020 & 2021

**Soybean
Response
Study**



Brooklyn, WI

Lancaster, WI

Macomb, IL

Arlington, WI

Janesville, WI

Macomb, IL

Study Information

Herbicide	Rate (g ai ha ⁻¹)	
	1x	1/3x
lactofen (Cobra)	219	73
fomesafen (Flexstar)	264	88
fluthiacet-methyl (Cadet)	7.2	2.4
flumiclorac (Resource)	60.3	20.1
bentazon (Basagran)	897	299
2,4-D choline (EnlistOne)	1067	---
glufosinate (Liberty 280 SL)	657	---

PRE	Valor (flumioxazin)	112
	Fierce (flumioxazin+pyroxasulfone)	70.4 + 89.3

Waterhemp Response Study			Herbicide Treatment	Soybean Response Study		
Weed Free?	Pre @ Planting	Rate		Rate	PRE @ Planting	Weed Free?
	NO	---	No PRE	---	NO	
	VALOR	VALOR	PRE only	FIERCE		
	1x	Cobra	1x			
	1x + 1x	Cobra + Liberty	1x + 1x			
	1x + 1/3x	Cobra + Liberty	1/3x + 1x			
	1x	Flexstar	1x			
	1x + 1x	Flexstar + Liberty	1x + 1x			
	1x + 1/3x	Flexstar + Liberty	1/3x + 1x			
	1x	Resource	1x			
	1x + 1x	Resource + Liberty	1x + 1x			
	1x + 1/3x	Resource + Liberty	1/3x + 1x			
	1x	Cadet	1x			
	1x + 1x	Cadet + Liberty	1x + 1x			
	1x + 1/3x	Cadet + Liberty	1/3x + 1x			
	1x	Basagran	1x			
	1x + 1x	Basagran + Liberty	1x + 1x			
	1x + 1/3x	Basagran + Liberty	1/3x + 1x			
	1x	Liberty	1x			
	1x + 1x	Enlist One	1x			
	1x + 1/3x	Enlist One + Liberty	1x + 1x			

NO! YES!

YES!

9

Study Information

	Waterhemp Response Study			Soybean Response Study		
Location	Brooklyn, WI	Lancaster, WI	Macomb, IL	Arlington, WI	Janesville, WI	Macomb, IL
Variety	P22T86E	P22T86E	36EA02	P22T86E	P22T86E	36EA02
Planting Date	May 22, 2020 May 25, 2021	May 20, 2020 May 17, 2021	May 5, 2020 NA	May 1, 2020 May 12, 2021	May 8, 2020 April 29, 2021	May 25, 2020 NA
PRE application	May 22, 2020 May 26, 2021	May 20, 2020 May 19, 2021	May 21, 2020 NA	May 1, 2020 May 12, 2021	May 8, 2020 April 29, 2021	May 28, 2020 NA
POST application (growth stage)	June 24, 2020 (V4) June 30, 2021 (V5)	July 1, 2020 (V6) June 17, 2021 (V6)	July 3, 2020 (V3)	June 25, 2020 (V4) June 26, 2021 (V4)	July 2, 2020 (V4) June 18, 2021 (V4)	June 29, 2020 (V5) NA
Waterhemp height @ POST	2-20 cm (2020) 2-22 cm (2021)	7-28 cm (2020) 4-13 cm (2021)	6-23 cm NA	Weed Free		
Waterhemp density @ POST	16-33 plants m ⁻² (2020) 12-40 plants m ⁻² (2021)	18-34 plants m ⁻² (2020) 1-13 plants m ⁻² (2021)	12-60 plants m ⁻² NA			

Data Collection

Waterhemp Response Study

1) Visual Control (%)

Soybean Response Study

- 1) Phytotoxicity (visual) (%)
- 2) Green Canopy Coverage (%)
- 3) Soybean Yield (kg ha^{-1})



response variable ~ herbicide + (1 | rep:siteyear)

Adjustment: Tukey's HSD

alpha = 0.05

Results

Waterhemp Response

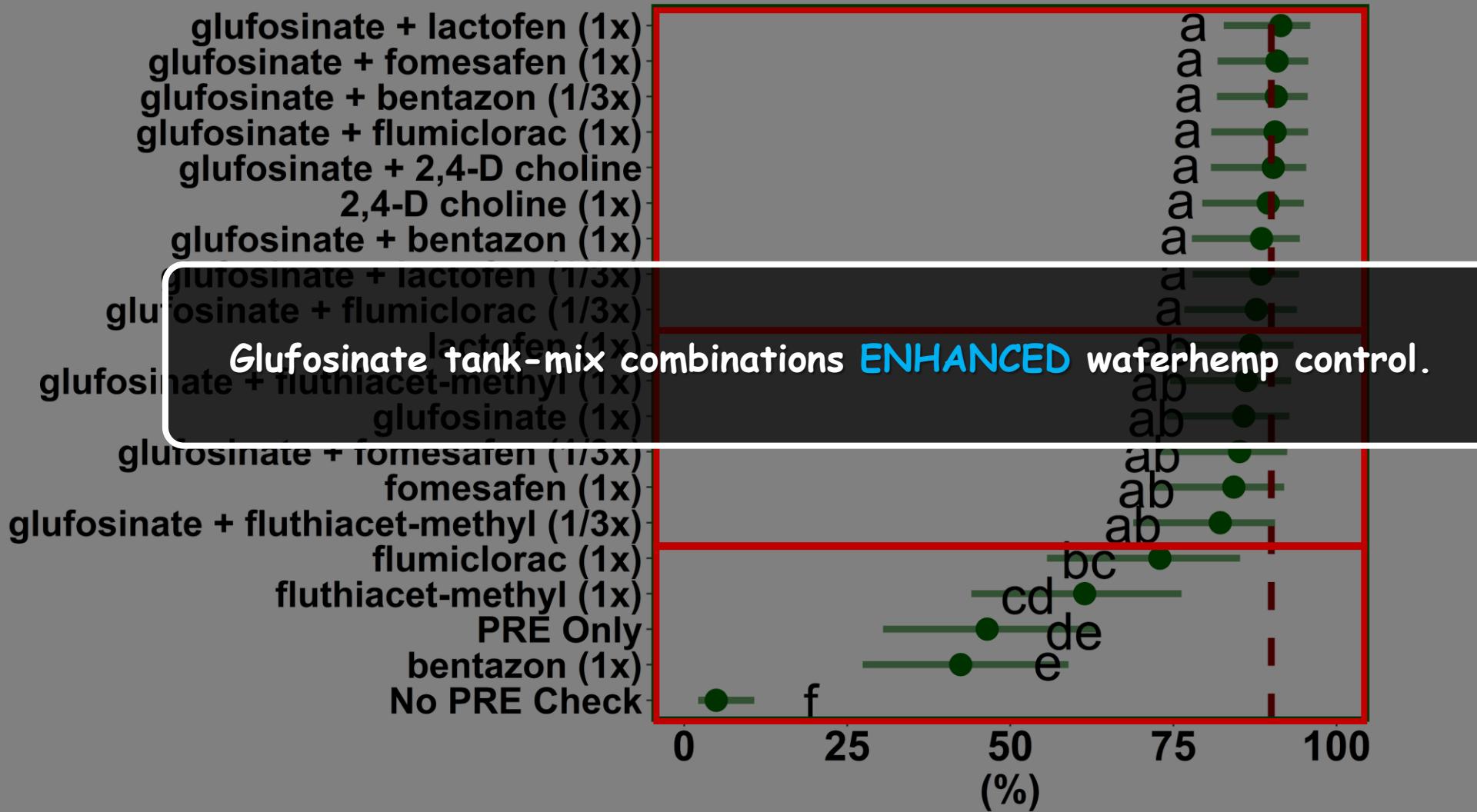
Visual Control (14 DAT)

```
model = glmmTMB(waterhempcontrol ~ herbicide + (1|rep:siteyear), beta_family (link = "logit"))
```

herbicide

p-value = <0.0001

Waterhemp Control - 14 DAT



Results

Soybean Response

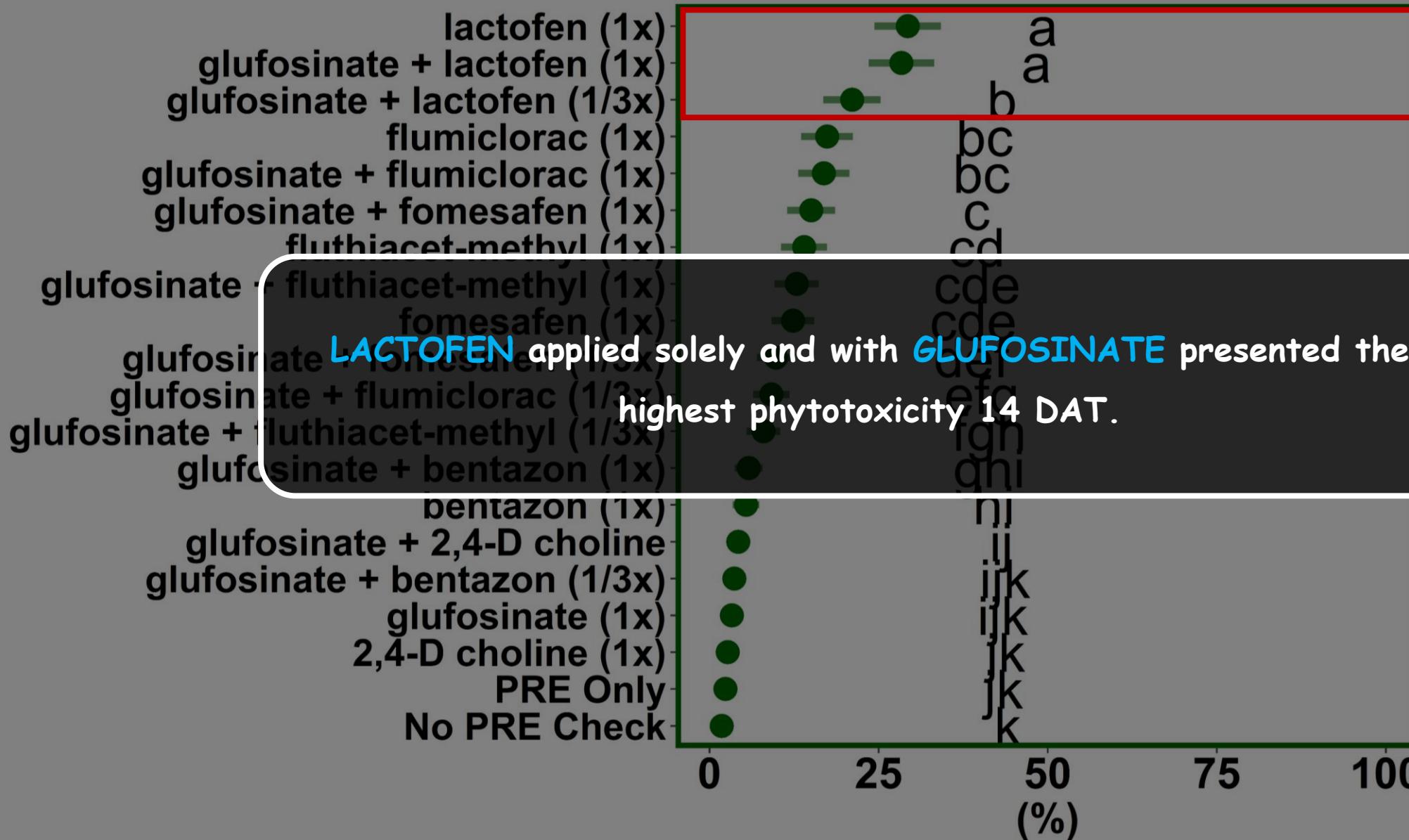
Phytotoxicity (14 DAT)

```
model = glmmTMB(phyto_p ~ herbicide + (1|rep:siteyear), beta_family (link = "logit"))
```

herbicide

p-value = <0.0001

Herbicide Phytotoxicity - 14 DAT



Results

Soybean Response

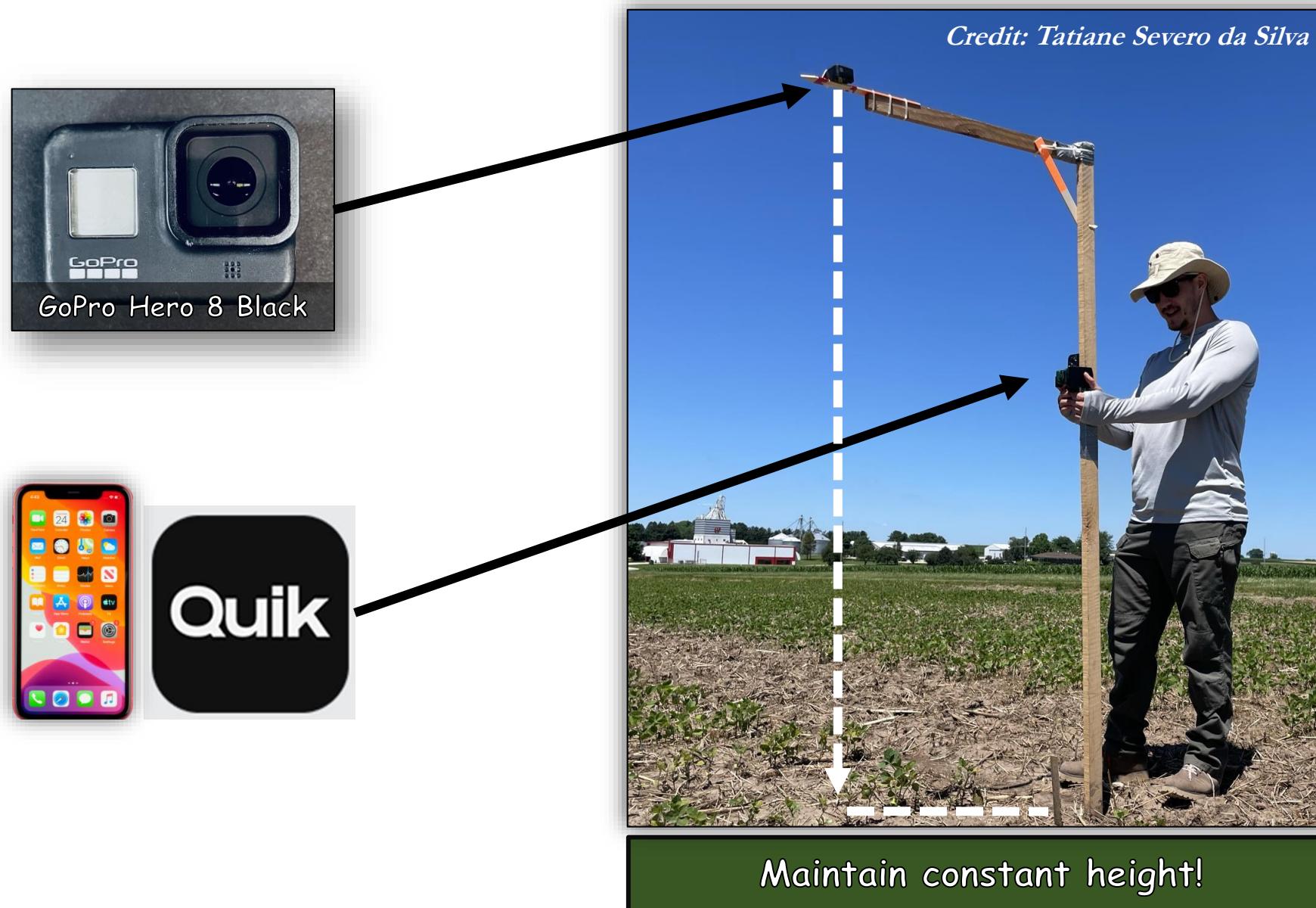
Green Cover Percentage - Canopeo (14 DAT)

```
model = glmmTMB(canopeo ~ herbicide + (1|rep:siteyear), beta_family(link = "logit"))
```

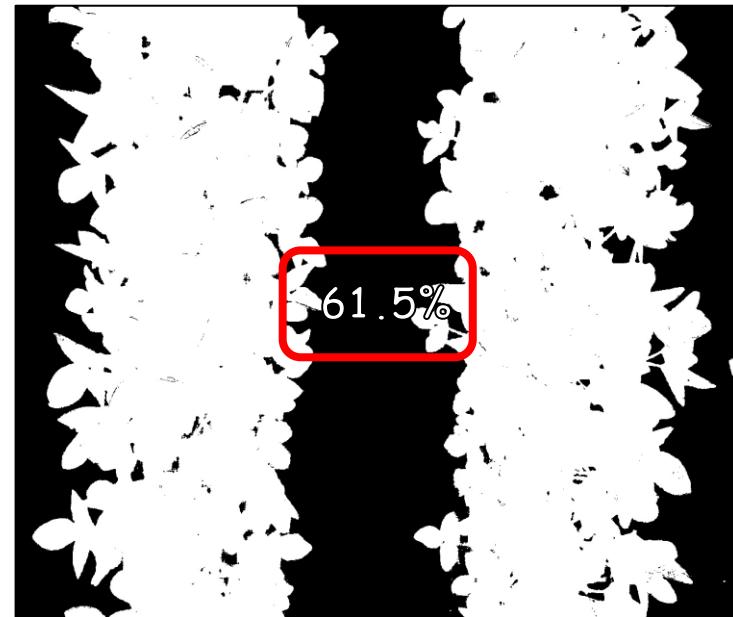
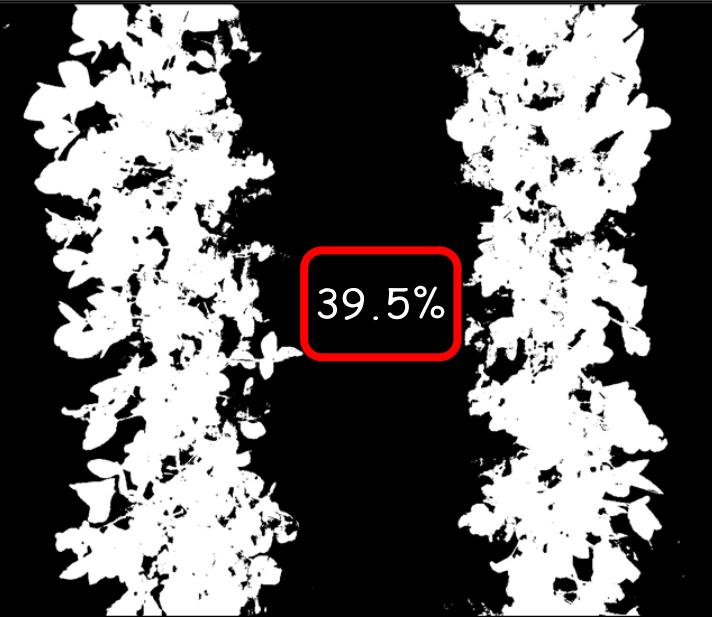
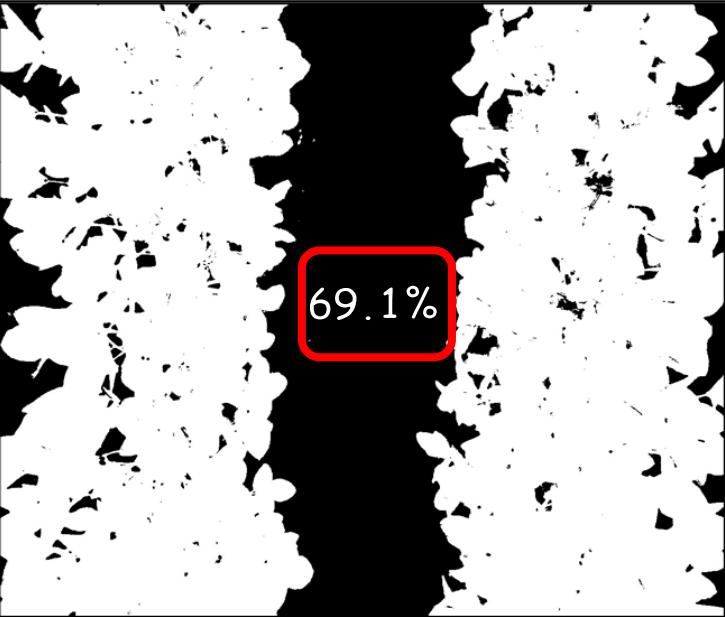
herbicide

p-value = <0.0001

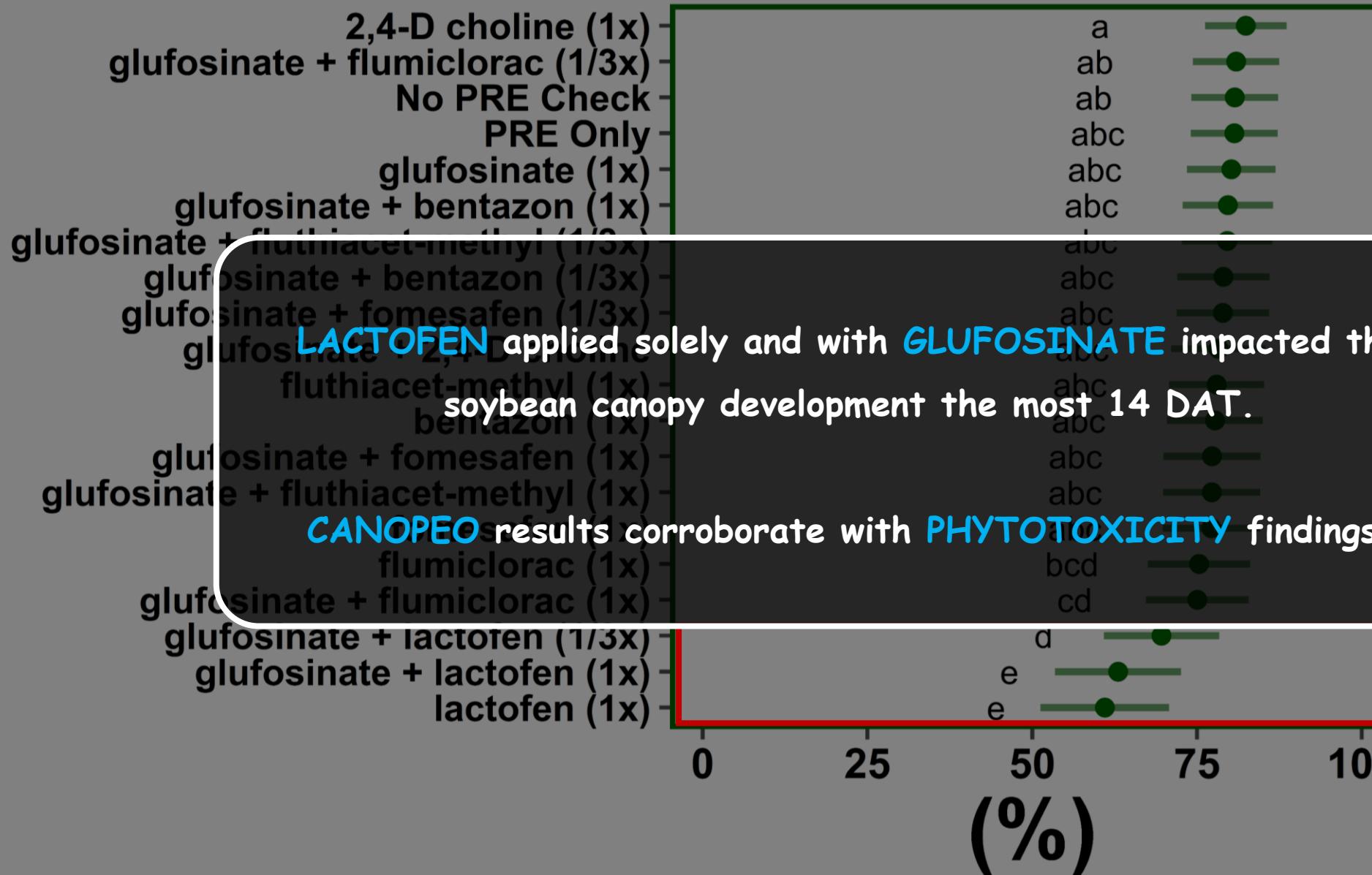
Green Cover Percentage (Canopeo)



Green Cover Percentage (Canopeo)



Soybean Green Cover Percentage - 14 DAT



Results

Soybean Response

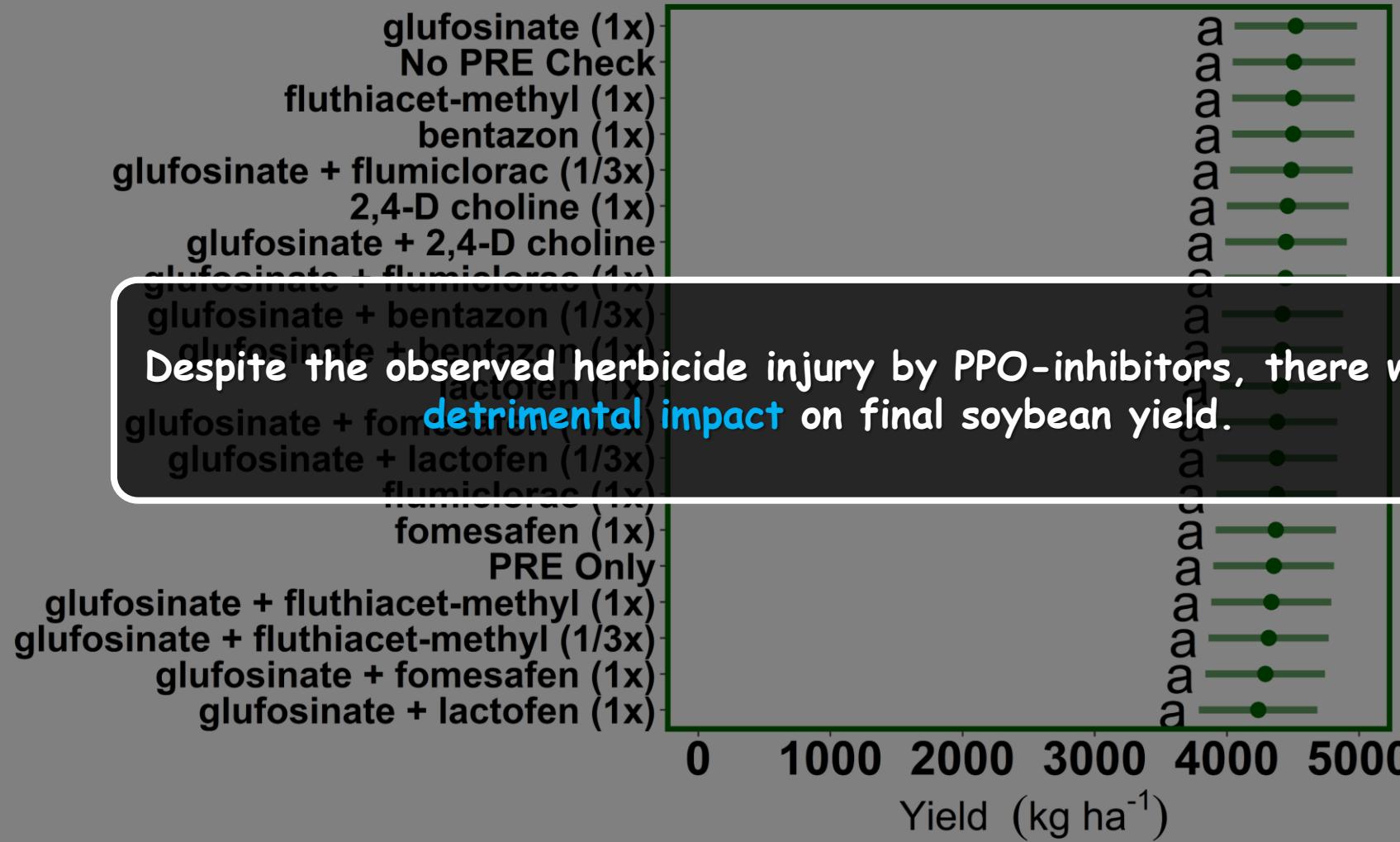
Soybean Yield

```
model = lmer(sqrt(yield_kg) ~ herbicide + (1|rep:siteyear))
```

herbicide

p-value = 0.09901

Soybean Yield



Take-Home Messages

- 1) Glufosinate tank-mix combinations enhanced POST-emergence waterhemp control.
- 2) Lactofen as a tank-mix partner can present a higher phytotoxicity risk, which is not necessarily translated into soybean yield loss.
- 3) Glufosinate tank-mix combinations could postpone herbicide resistance evolution.

Future Research

Investigate what influence does different carrier volume and nozzle selection with glufosinate tank-mix combinations have on waterhemp control, and soybean herbicide injury.

References

- Takano, H., Beffa, R., Preston, C., Westra, P., & Dayan, F. (2020). Glufosinate enhances the activity of protoporphyrinogen oxidase inhibitors. *Weed Science*, 68(4), 324-332. doi:10.1017/wsc.2020.39
- <https://marketresearch.biz/report/herbicides-market/>

Acknowledgements

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BRIEN HYBRIDS



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